

Claims:

Sub 1

1. A unidirectional valve comprising:
a valve body including a frame, a valve opening through the frame, and a valve seat extending from the frame and at least partially surrounding the valve opening; and
a valve flap having a first portion attached to the frame and an adjacent second portion free to move from a first position where the second portion is in contact with at least a part of the valve seat to a second position where at least part of the second portion is spaced from the valve seat, wherein the valve flap has a nonuniform thickness.

2. The unidirectional valve of claim 1, wherein the valve flap further comprises a first side spaced from a second side, and wherein the valve thickness varies between the first and second sides.

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3. The unidirectional valve of claim 2, wherein the valve flap has a minimum thickness and a maximum thickness between the first and second sides, and wherein the maximum thickness is at least about 10% greater than the minimum thickness.

4. The unidirectional valve of claim 1, wherein the valve flap further comprises a first end spaced from a second end, and wherein the valve thickness varies between the first and second ends.

5. The unidirectional valve of claim 4, wherein the valve flap has a minimum thickness and a maximum thickness between the first and second ends, and wherein the maximum thickness is at least about 10% greater than the minimum thickness.

6. The unidirectional valve of claim 1, wherein the valve flap further comprises a top surface, a bottom surface, and at least one rib extending from the top surface of the valve flap.

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Sub 7. The unidirectional valve of claim 6, wherein the at least one rib provides the nonuniform thickness of the valve flap.

Sub 8. The unidirectional valve of claim 7, further comprising a plurality of ribs, wherein each of the plurality of ribs is spaced from each adjacent rib.

9. The unidirectional valve of claim 1, wherein the valve seat is generally planar and the valve flap has a curvature that causes a bias of the valve flap toward the valve seat to provide a seal between the valve flap and the valve seat.

10. The unidirectional valve of claim 9, wherein at least a portion of the curvature of the valve flap is at least partially flattened when the valve flap contacts the valve seat.

11. The unidirectional valve of claim 9, wherein the bias of the valve flap toward the valve seat is sufficient to provide a seal between the valve flap and the valve seat in any orientation of the unidirectional valve.

12. The unidirectional valve of claim 1, wherein the valve flap has a stiffness and a mass, wherein the valve flap and a second valve flap have the same perimeter, shape, and attachment means, and wherein the ratio of the stiffness to the mass of the valve flap is higher than for the second valve flap having a uniform thickness.

Sub 13. The unidirectional valve of claim 1, wherein the valve flap has a bottom surface that is generally planar and wherein the valve seat is generally nonplanar.

14. The unidirectional valve of claim 1, wherein the frame of the valve body includes an angled portion adjacent the valve seat.

15. The unidirectional valve of claim 1, wherein the valve is an exhalation valve.

16. The unidirectional valve of claim 1, wherein the valve is an inhalation valve.

17. The unidirectional valve of claim 1, wherein the valve flap is removably attached to the valve body.

18. A respirator having a unidirectional valve, comprising;
a face mask having at least one opening for receiving a unidirectional valve; and

a unidirectional valve comprising:

a valve body including a frame, a valve opening through the frame, and a valve seat extending from the frame and at least partially surrounding the valve opening; and

a valve flap having a first portion attached to the frame and an adjacent second portion free to move from a first position where the second portion is in contact with at least a part of the valve seat to a second position where at least part of the second portion is spaced from the valve seat, wherein the valve flap has a nonuniform thickness.

19. The respirator of claim 18, wherein the face mask is formed of a filtering material.

20. The respirator of claim 18, wherein the unidirectional valve is an exhalation valve.

21. The respirator of claim 18, wherein the unidirectional valve is an inhalation valve.